

FINAL REPORT
HOPI ARSENIC MITIGATION PROJECTS
HOPI INDIAN RESERVATION
NAVAJO COUNTY, ARIZONA

PROJECT NO. PH 04-S63, PH 06-D33, PH 08-T38, PH 10-E37
PUBLIC LAW 86-121

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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BACKGROUND

Public Water Systems (PWSs) serving the First and Second Mesa Hopi Villages of Mishongnovi, Polacca, Shungopavi, Sichomovi, Sipaulovi, Tewa, and Walpi on the Hopi Reservation exhibit arsenic concentrations in excess of the Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL) per the Safe Drinking Water Act (SDWA). Utilities at First and Second Mesa provide water with arsenic concentrations between 14 and 20 parts per billion (ppb), which is in excess of the 2001 arsenic MCL update from 50 to 10 ppb. The utilities vary in their size, structure, ability, and are not mutually exclusive from their respective corresponding Village, Tribal, or Federal organizational structure. Most residents on the Hopi Reservation in general, including First and Second Mesas, are served by utilities that are owned and operated by Villages. The Hopi Tribe's primary role is as a focal point in the government to government relationship with the United States since the Tribe's constitution and bylaws describe itself as a union of self-governing Villages that each have their own unique and autonomous form of government structure (e.g. traditional, constitutions subordinate to the Tribe's, elected officials, etc.) Therefore, the Tribe requested the assistance of the Indian Health Service (IHS) and EPA on behalf of the tribal members, villages, and utilities to address sanitation deficiencies associated with water quality and quantity. Ultimately, IHS Projects PH 04-S63, PH 06-D33, PH 08-T38, and PH 10-E37 were funded and approved to provide the requested technical assistance to the Tribe for the approximately 1,300 affected homes at First and Second Mesa.

Since the original involvement of the IHS under PH 04-S63, many alternative solutions to the water quality and quantity issues have been explored with each project described herein having become part of what is now cumulatively known as the Hopi Arsenic Mitigation Project (HAMP). The HAMP is an ongoing cooperative effort led by The Hopi Tribe and has undergone significant changes, additions, and involved numerous stakeholders including: the Tribe, Villages, utilities, EPA,

IHS, Department of Housing and Urban Development (HUD), Hopi Tribal Housing Authority (HTHA), Bureau of Indian Affairs (BIA), Bureau of Indian Education (BIE), Bureau of Reclamation (BOR), and United States Department of Agriculture (USDA). There have been numerous public community outreach meetings throughout the years in addition to a monthly EPA conference call emphasizing the HAMP on the first Thursday of the month, which has been held for the past decade. Reception and support for the HAMP is seemingly universal, with the primary deterrent being lack of funding.

While the HAMP is still in-progress, the scopes of PH 04-S63, PH 06-D33, PH 08-T38, and PH 10-E37 are complete at this time and are administratively closed per this report. Additionally, the Tribe and EPA have funded subsequent ongoing projects that are considered wholly or partially components of the HAMP under IHS Projects PH 11-E55, PH 12-E73, PH 14-U62, PH 15-U76, and PH 15-E89. Funding for PH 04-S63 and PH 08-T38 was provided by the IHS through "Regular" funds with funding for PH 06-D33 and PH 10-E37 provided by the EPA through SDWA Tribal Set-Aside funds. The following facilities were proposed per each respective Project Summary:

PH 04-S63

- Research groundwater quality with respect to arsenic at First Mesa (i.e. Polacca, Sichomovi, Tewa, and Walpi), which is operated by First Mesa Consolidated Villages (FMCV)
- Well pumphouse/treatment building
- Proposed community water well
- Water main extension
- Installation of electrical panels and well controls

PH 06-D33

- Research arsenic mitigation strategies for PWSs on the Hopi Reservation and publish a feasibility study for arsenic rule compliance for the following water systems:
 - FMCV (PWS ID 090400107)
 - Hopi Cultural Center (PWS ID 090400260)
 - BIE Second Mesa Day School (PWS ID 090400061)
 - Lower Sipaulovi/Mishongnovi (PWS ID 090400107)
 - Upper Sipaulovi/Mishongnovi (PWS ID 090400394)
 - Shungopavi (PWS ID 0400259)
 - Hopi High School (PWS ID 0400395)
- Amended to prepare construction documents including:
 - Geotechnical analysis
 - Environmental Assessment

- o Aerial mapping
- o GPS equipment

PH 08-T38

- Conduct a Hopi Regional Water Study to assess the feasibility of creating a regionalized Hopi water system and to specifically evaluate the following:
 - o Identify locations for wells and water storage tanks
 - o Provide preliminary design concepts
 - o Layout transmission main alignments
 - o Assess ROW requirements
 - o Conduct an Environmental Assessment
 - o Develop water system management schemes
 - o Identify terms of utility agreements and rates
 - o Define and prioritize needed improvements to existing water system facilities
- The Hopi Regional Water Study was to encompass the following geographic areas and PWSs:
 - o BIA Keams Canyon (PWS ID 090400054)
 - o BIE Second Mesa
 - o Toreva (PWS ID 09040055)
 - o Hopi Cultural Center
 - o BIE Hopi High School
 - o Upper Mishongnovi/Sipaulovi
 - o Lower Mishongnovi/Sipaulovi
 - o FMCV
 - o Shungopavi
 - o Turquoise Trail
 - o Hopi Veteran's Center
 - o Kykotsmovi (PWS ID 090400105)
 - o Old Oraibi
 - o Bacavi (PWS ID 090400687)
 - o Hotevilla (PWS ID 090400700)

PH 10-E37

- Construct a drinking water well (18" borehole, 14" casing, 12" perforated casing, with pump/motor, drop pipe, and pitless adapter, etc.) at Turquoise Trail
- Rehabilitate the existing Turquoise Trail well (well pump/motor, drop pipe, and pitless adapter, etc.)
- Extend NTUA electric power to the Turquoise Trail well sites
- Conduct a hydrogeologic assessment of the aquifer
- Develop an asset management plan

HISTORY

IHS involvement with arsenic mitigation on the Hopi Reservation began with PH 04-S63 at First Mesa. A similar project, PH 06-D33 evaluated arsenic mitigation at Second Mesa and treatment technologies at First Mesa. The Hopi Tribe subsequently decided to pursue a regionalized/rural water system to serve the First and Second Mesa Utilities with water from Turquoise Trail in an effort to maximize the economies of scale with respect to correcting the arsenic MCL deficiencies per the scopes of PH 08-T38 and PH 10-E37. From 2007 to 2012, the individual projects were further developed into the HAMP as further described in the below project-specific histories. Planning and design funding of the HAMP has generally followed Method 2 per the *SFC Project Management Program (PMPro) Project Management Guideline* in that it has been a major planning and design project with significant costs to-date per Chapter 5 Section VI of the *2003 Criteria for the Sanitation Facilities Construction Program* under the associated IHS projects. Counting only IHS resources; the HAMP has had five IHS Project Engineers in the IHS lead as of August 2016 plus frequent and intensive support from numerous IHS Technicians, Engineers, Utility Consultants, National Environmental Protection Act (NEPA) Coordinators, Division Directors, and administrative staff. HAMP planning and design efforts have been predicated upon garnering USDA Rural Development (RD) funding since other funding entities do not have easy mechanisms to provide the required remaining total of \$16.9M to complete the project.

Following years of planning, a draft Preliminary Engineering Report (PER) for the HAMP was published in 2012 and reviewed by USDA RD. Following review of the PER, the stakeholder consensus was that the best course of action was to drill the two wells required in the rural water system alternative per the *Turquoise Trail Hydrogeologic Study* (Young, 2011) in an effort to prove the quality and quantity. In December 2012, a project manual was completed for the drilling of the two wells and an invitation for sealed bids to perform work was advertised by The Hopi Tribe. There was one responsive, responsible bidder, Yellow Jacket Drilling Services of Phoenix, AZ. Yellow Jacket Drilling Services was awarded the contract to drill Turquoise Trail Wells #2 and #3, which were successfully completed. Turquoise Trail Wells #2 and #3 validated the concept of a rural water system alternative as they are expected to produce 415 gallons per minute each and exhibit arsenic concentrations of 4.7 and 4.2 ppb, respectively (Fritz et al. 2014).

Efforts to evaluate and include the BIA/BIE PWSs in the HAMP were concluded with publication of the *Arsenic Mitigation Study for BIA Public Water Systems, Keams Canyon, Arizona* (D.B. Stephens, 2011), *Preliminary Engineering Report for The Hopi Tribe Keams Canyon Proposed Project Connection to the HAMP Proposed SDS Project* (Mitchell, 2013), and installation of interim arsenic treatment facilities. After arsenic issues with the BIA/BIE PWSs were corrected, the focus of the IHS and stakeholders shifted to correct the existing MCL issues at the utilities still out of compliance with the MCL and to select a preferred alternative for the HAMP. Similarly, stakeholders decided that the BIA/BIE needed to commit to the HAMP in writing to demonstrate financial capability of amortization of a USDA RD loan or present worth capital equivalent prior to investing additional resources in the BIA/BIE inclusion.

Project PH 14-E90 may be funded to further evaluate and plan BIA/BIE HAMP inclusion as described in the similarly scoped IHS Sanitation Deficiency System (SDS) entry "AZ09971-0102 - Keams Canyon HAMP Connection." The project has been signed by The Hopi Tribe per Hopi Tribal Council Resolution H-030-2015, but not yet executed/funded as the BIA has not yet signed the MOA (i.e. on behalf of both the BIA and BIE). The BIA and Tribe intend to fund the inclusion of the BIA/BIE in the HAMP. All of the BIA and BIE systems operate arsenic treatment plants to provide potable water and have identified the HAMP as their preferred future water source per the *Arsenic Mitigation Study for BIA Public Water Systems, Keams Canyon, Arizona*. However, the scope of the planning study was such that the assumptions include unlimited sources of potable water at the nearest possible connection points to existing PWSs in First and Second Mesa. A Bentley WaterGEMS model shows that the proposed HAMP mains to both First and Second Mesa would need to be sized larger to include the BIA and BIE systems than necessary to serve the other utilities. Additionally, there are not hydraulic analyses of each respective PWS to demonstrate that connecting directly to them is within each system's capacity. Consequentially, the capital costs previously identified for each BIA/BIE system are likely artificially low and could affect the alternative decision matrices if developed further.

Technical assistance provided by the IHS culminated in the completion of reports necessary for a USDA RD Grant Application including: *Preliminary Engineering Report for Hopi Arsenic Mitigation Alternatives*, *IHS Project PH12-E73, PH11-E55, PH10-E37, PH08-T38, PH06-D33, PH04-S63* (Hughes, 2014), *Hopi Water System Strategic Plan An Element of the Hopi Arsenic Mitigation*

Project Final Report (Brough et al. 2014a), *Hopi Arsenic Mitigation Project Life Cycle Cost Analysis and Comparison of Arsenic Mitigation Alternatives: HAMP Groundwater System and Village Arsenic Treatment Systems Final Report* (Brough et al. 2014b), and the *Environmental Assessment for Hopi Arsenic Mitigation Project, Hopi Reservation, Navajo County, Arizona* (Indian Health Service, 2014). The reports provide a more comprehensive description of the HAMP than this Final Report and have been provided to the Tribe, Villages, and utilities.

The preferred alternative identified in the *Preliminary Engineering Report for Hopi Arsenic Mitigation Alternatives, IHS Project PH12-E73, PH11-E55, PH10-E37, PH08-T38, PH06-D33, PH04-S63* (Hughes, 2014), hereinafter and elsewhere referred to as the HAMP PER, is a rural water system of sufficient water quality and quantity to provide potable water to the participating Utilities of First and Second Mesa (i.e. not including PWSs operated by the BIA or BIE). Therefore, when the HAMP is cited it typically refers to the preferred alternative of a rural water system synonymously with the HAMP (i.e. not treatment alternatives). There has not yet been a USDA RD review of the HAMP PER.

The project specific history, especially with respect to funds disbursement (see also Table 3), is more comprehensively summarized is as follows.

Project PH 04-S63:

In September 2004, the IHS and The Hopi Tribe (Hopi Tribal Council Resolution H-078-2004) entered into a Memorandum of Agreement (MOA) for Project PH 04-S63 with support from FMCV and Traditional Leaders of the Villages. The project was to investigate the feasibility of drilling a community water well at a location and depth that would provide arsenic compliant water to First Mesa without requiring treatment to remove arsenic. By 2007, a review of available literature and continued water quality sampling lead the IHS to conclude that there were no locations nor depths in or around First Mesa that would yield potable water which would not first need treatment to remove arsenic while still being compliant with other EPA water quality standards. In 2008, the PH 04-S63 scope shifted to the HAMP scope, which will conceptually provide water from the Turquoise Trail area to the north of First Mesa. Turquoise Trail is land claimed by First Mesa Traditional Leadership and Clans, with some land disputes at the Tribal level (see SIGNIFICANT PROJECT/CONSTRUCTION EVENTS).

Ultimately, almost all of the funding contributions to the Tribe under PH 04-S63 were used to drill Turquoise Trail Wells #2 and #3. Some funds were also used to produce the *Hopi Water System Strategic Plan An Element of the Hopi Arsenic Mitigation Project Final Report*, which is an integral part of the HAMP PER.

Project PH 06-D33:

In October 2006, the IHS, the US EPA, and the Hopi Tribe (Hopi Tribal Council Resolution H-080-2006) entered into a MOA for Project PH 06-D33. The project was scoped to research arsenic mitigation strategies for Hopi PWSs and to publish a feasibility study for arsenic rule compliance for the following water systems: First Mesa Consolidated Villages, Hopi Cultural Center, Second Mesa Day School, Lower Sipaulovi/Mishongnovi, Upper Sipaulovi/Mishongnovi, Shungopavi, and Hopi High School.

In November 2008, Amendment #1 to the project summary and MOA were signed, which increased the scope of work and project funding by \$25,000. The scope was increased to provide for additional technical assistance by the IHS to the Second Mesa Day School, which was experiencing ongoing operational issues with its recently installed arsenic treatment facility. Additional funding was provided by the US EPA and the technical assistance was provided by the IHS. In May 2010, Amendment #2 to the project summary and MOA were signed, which amended the scope of work to allow for the purchase of GPS surveying equipment for surveying the HAMP alignment and for ongoing design activities associated with the HAMP.

IHS decided to perform the PH 06-D33 scope of work in-house and consequently hired an engineer to carry out the planning scope in 2007. A significant amount of water samples and existing data were collected from 2007 through 2008 to comprehensively evaluate the drinking water of the First and Second Mesa PWSs. There were also significant resources invested in community outreach meetings and evaluation of the BIA/BIE treatment systems. In fulfillment of the project scope of work and in conjunction with other similar funded arsenic mitigation projects, the IHS published the *Public Water System Feasibility Study for Sipaulovi/Mishongnovi* (Crownholm, 2007), which was delivered to The Hopi Tribe and the EPA. The Tribe subsequently applied for a Safe Drinking Water Act Tribal Set-Aside grant in 2007 to perform the scope of work identified in the feasibility study, but was not funded due to being phased such that the scope did not provide direct service to homes.

Ultimately, the majority of PH 03-D33 funding was spent to provide inspection services during the drilling of the Turquoise

Trail wells and to develop an Environmental Assessment for HAMP PER alternatives. Both scopes of work were issued to and completed by Bohannon Huston. Well inspection services were provided by Bohannon Huston via John Shomaker and Associates. Following inspection and testing, the *Well Report for Hopi Arsenic Mitigation Project Wells No. 2 and No. 3* (Fritz et al. 2014) was published. Environmental Assessment preparation was extensive and resulted in publication of the following reports: *Environmental Assessment for Hopi Arsenic Mitigation Project, Hopi Reservation, Navajo County, Arizona* (Indian Health Service, 2014), *Threatened and Endangered species Survey for the Hopi Arsenic Mitigation Project* (Sahmea, 2012), *Biological Evaluation Report #013-12: Department of Health and Human Services, Indian Health Services, Hopi Arsenic Mitigation Project* (Talayumptewa, 2012), *Biological Evaluation Report #004-14: Department of Health and Human Services, Indian Health Services, Hopi Arsenic Mitigation Project* (Talayumptewa, 2014), *A Cultural Resources Inventory of the Hopi Arsenic Mitigation Project, Hopi Indian Reservation, Navajo County, Arizona, HCPO 2011-024* (Yeatts and Kuwanwisiwma, 2013), *A Cultural Resources Inventory of Additional Storage Tank Locations for the Hopi Arsenic Mitigation Project, HCPO 2011-024B* (Yeatts and Kuwanwisiwma, 2014), and *HAMP Addendum C: Archaeological Inventory of an Alternate Supply Well Location. HCPO 2011-024C* (Yeatts, 2014).

Project PH 08-T38:

In October 2008, the IHS and The Hopi Tribe entered into a MOA for Project PH 08-T38. The project was scoped to assess the feasibility of creating a regionalized water system. In addition to the water needs of First and Second Mesa, the needs of Third Mesa were evaluated and determined to be overly complicated both technically and politically to address in the HAMP. Furthermore, the Third Mesa systems were determined to be more of a master planning type effort and outside of the scope of the arsenic mitigation efforts due to the potable water provided by the PWSs being in compliance with the arsenic MCL with no other apparent deficiencies. The focus of the IHS and stakeholders then completely shifted to correct the existing MCL issues at the utilities still out of compliance with the MCL and to select a preferred alternative for the HAMP.

Ultimately, nearly all of the funding contributions to The Hopi Tribe were used to drill Turquoise Trail Wells #2 and #3 under EA 11-12 in an effort to prove the water source as a valid alternative.

Project PH 10-E37:

In July 2010, the IHS and The Hopi Tribe (Hopi Tribal Council Resolution H-035-2010) entered into a Memorandum of Agreement (MOA) for Project PH 10-E37. The project was funded to drill a community water well at Turquoise Trail, which would become the water source in the proposed rural water system alternative. It was also proposed to rehabilitate Turquoise Trail Well #1 and to extend power from the Navajo Tribal Utility Authority (NTUA) to the two Turquoise Trail well sites. In addition to drilling, it was proposed that a hydrogeologic study be conducted to determine the aquifer characteristics of the Turquoise Trail. Finally, funds were allocated towards development of an asset and operations management plan for the future utility that would own and operate the proposed water system(s).

Project funds were used to produce Kennedy Jenks' *Turquoise Trail Hydrogeologic Study* (Young, 2011), which recommended the drilling of a new Turquoise Trail Well and to rehabilitate the existing Turquoise Trail Well #1. Kennedy Jenks provided a well drilling specification, locations, drawdowns, and capture zones for completion of three proposed wells at full build-out including rehabilitation of the existing Well #1. It was decided to not rehabilitate Well #1 due to: insufficient casing size to install a large enough production pump per HAMP needs, non-full aquifer penetration per *The Hopi Tribe Standard Specification for Well Construction and Pump Installation* (1996), need to cross the Oraibi Wash with a water main, and land control/ordinance issues associated with the Tawa'ovi Community. The study and specifications were used in the bid package to drill Turquoise Trail Wells #2 and #3.

Kennedy Jenks was also selected to conduct the asset management and operations plan for the proposed utility with funds from PH 10-E37. The asset management plan was finalized in September 2014 and is known as the *Hopi Water System Strategic Plan An Element of the Hopi Arsenic Mitigation Project Final Report*. Additionally, Kennedy Jenks published the *Life Cycle Cost Analysis and Comparison of Arsenic Mitigation Alternatives*, which analyzed and compared the net present value of the HAMP concept in comparison to implementing arsenic treatment systems in each individual village. Both reports were integral to the HAMP PER and necessary for The Hopi Tribe to complete the USDA RD application package.

Ultimately, the majority of PH 10-E37 fund contributions to The Hopi Tribe were used to drill Turquoise Trail Wells #2 and #3 under EA 11-12.

A chronological summary of project-specific events is summarized in Table 1.

Table 1 - Chronology of Events

PH 04-S63

Project Request	April 2004
Project Summary	September 29, 2004
Memorandum of Agreement	September 28, 2004
Environmental Review	September 30, 2004
Construction Started	June 10, 2013
Construction Completed	December 22, 2014
Planning Completed	September 4, 2014
Acknowledgement Of Project Completion	

PH 06-D33

Project Request	November 15, 2005
Project Summary	September 21, 2006
Memorandum of Agreement	September 25, 2006
Environmental Review	September 21, 2006
Amendment No. 1 to the Project Summary	October 16, 2008
Amendment No. 1 to the MOA	December 3, 2008
Amendment No. 2 to the Project Summary	May 3, 2010
Amendment No. 2 to the MOA	May 13, 2010
Planning Completed	September 4, 2014
Acknowledgement Of Project Completion	

PH 08-T38

Project Request	May 15, 2008
Project Summary	September 29, 2008
Memorandum of Agreement	October 1, 2008
Environmental Review	October 1, 2008
Construction Started	June 10, 2013
Construction Completed	December 22, 2014
Planning Completed	September 4, 2014
Acknowledgement Of Project Completion	

PH 10-E37

Project Request	October 1, 2009
Project Summary	June 29, 2010
Memorandum of Agreement	July 1, 2010
Environmental Review	July 12, 2010
Construction Started	June 10, 2013
Construction Completed	December 22, 2014
Planning Completed	September 4, 2014
Acknowledgement Of Project Completion	

SUMMARY OF FACILITIES PROVIDED

Water: The facilities provided under PH 04-S63, PH 06-D33, PH 08-T38, and PH 10-E37 include Turquoise Trail Wells #2 and #3 and the reports produced per Table 2.

Table 2 - Facilities Provided

Description

Turquoise Trail Well #2

- 2,180-feet deep in 2,195-foot, 18-inch reamed borehole
- 1,700-feet of 12-inch i.d. HSLA casing
- 480-feet of 12-inch i.d. 304 stainless steel screen

Turquoise Trail Well #3

- 2,241-feet deep in 2,270 foot, 22-inch reamed borehole
- 1,761-feet of 12-inch i.d. HSLA casing
- 480-feet of 12-inch i.d. 304 stainless steel screen

Beckman, B.L. (2012). *Draft Preliminary Engineering Report for Hopi Arsenic Mitigation Project, IHS Project #'s PH11-E55, PH10-E37, PH08-T38, PH06-D33, PH04-S63*, Indian Health Service. Lakeside, AZ.

Brough, K. (2014a). *Hopi Water System Strategic Plan An Element of the Hopi Arsenic Mitigation Project Final Report*, GHD and OEM Services for Kennedy Jenks Consultants, Phoenix, AZ.

Brough, K. (2014b). *Hopi Arsenic Mitigation Project Life Cycle Cost Analysis and Comparison of Arsenic Mitigation Alternatives: HAMP Groundwater System and Village Arsenic Treatment Systems Final Report*, GHD and OEM Services for Kennedy Jenks Consultants, Phoenix, AZ.

Crownholm, J. (2007). *Public Water System Feasibility Study Sipaulovi/Mishongnovi, Arizona*, Indian Health Service, Lakeside, AZ.

Fritz, S., Peery, R., and Shomaker, J.W. (2014). *Well Report for Hopi Arsenic Mitigation Project Wells No. 2 and No. 3*, Hopi Tribe, Arizona, John Shomaker and Associates Inc. for Bohannon Huston, Inc., Albuquerque, NM.

Hughes, A.E. (2014). *Preliminary Engineering Report for Hopi Arsenic Mitigation Alternatives, IHS Project PH12-E73, PH11-E55, PH10-E37, PH08-T38, PH06-D33, PH04-S63*, Indian

Health Service, Lakeside, AZ.

Indian Health Service (2014). *Environmental Assessment for Hopi Arsenic Mitigation Project, Hopi Reservation, Navajo County, Arizona*, Phoenix Area Indian Health Service, Indian Health Service, Phoenix, AZ.

Mitchell, P. (2013). *Preliminary Engineering Report for The Hopi Tribe Keams Canyon Proposed Project Connection to the HAMP Proposed SDS Project*, Indian Health Service, Polacca, AZ.

Sahmea, D. (2012). *Threatened and Endangered species Survey for the Hopi Arsenic Mitigation Project*, Hopi Tribe Office of Range Management/Land Operations, Kykotsmovi, AZ.

Talayumptewa, D. (2012). *Biological Evaluation Report #013-12: Department of Health and Human Services, Indian Health Services, Hopi Arsenic Mitigation Project (HAMP), Hopi Wildlife and Ecosystems Management Program*, Kykotsmovi, AZ.

Talayumptewa, D. (2014). *Biological Evaluation Report #004-14: Department of Health and Human Services, Indian Health Services, Hopi Arsenic Mitigation Project (HAMP), IHS Project #PH 11-E55, Hopi Wildlife and Ecosystems Management Program*, Kykotsmovi, AZ.

Yeatts, M., and Kuwanwisiwma, L. (2013). *A Cultural Resources Inventory of the Hopi Arsenic Mitigation Project, Hopi Indian Reservation, Navajo County, Arizona, HCPO 2011-024*, Hopi Cultural Preservation Office, Kykotsmovi, AZ.

Yeatts, M., and Kuwanwisiwma, L. (2014). *A Cultural Resources Inventory of Additional Storage Tank Locations for the Hopi Arsenic Mitigation Project, HCPO 2011-024B*, Hopi Cultural Preservation Office, Kykotsmovi, AZ.

Yeatts, M. (2014). *HAMP Addendum C: Archaeological Inventory of an Alternate Supply Well Location. HCPO 2011-024C*, Hopi Cultural Preservation Office, Kykotsmovi, AZ.

Young, R.F. (2011). *Turquoise Trail Hydrogeologic Study*, Kennedy Jenks Consultants. Rancho Cordova, CA.

SIGNIFICANT PROJECT/CONSTRUCTION EVENTS

The well drilling contractor, Yellow Jacket Drilling Services, experienced several adverse issues during the well drilling. The most significant issue was the failure of the first attempt to drill Well #3 due to equipment failure that led to the loss of 1,600 ft of tremie pipe downhole, which was never recovered. Yellow Jacket Drilling Services proposed to and was authorized by The Hopi Tribe to move and re-drill approximately 50 feet from the original Well #3, which was abandoned per the contract specifications. The second attempt at drilling Well #3 resulted in a larger borehole (i.e. 22-inch versus the originally specified 18-inch) and was successfully completed. Excessive sanding was experienced in Well #2 (likely) due to insufficient development time, which was corrected as a deficiency identified in the Final Inspection. The completed wells were per the contract documents and met or exceeded the quality and design quantity of production water expected per the *Turquoise Trail Hydrogeologic Study*.

There were some relevant issues with respect to land access encountered during the drilling of the Turquoise Trail Wells that remain relevant for future HAMP and IHS project construction in general. First Mesa Villages/Clans took exception to the presence of Yellow Jacket Drilling Services operating at Turquoise Trail as they did not give explicit formal permission in addition to or in agreement with The Hopi Tribe pursuant to the *Constitution and By-laws of the Hopi Tribe* as follows: "Assignment of use of farming land within the traditional clan holdings of the Villages [which are enumerated] as in effect at the time of approval of [the] Constitution, shall be made by each village..." IHS contacted the Tribe in an effort to resolve First Mesa's claims to the land, which resulted in a seven page response instructing the IHS to stay out of Tribal affairs and continue the IHS's role in well drilling without hesitation. The issue is seemingly resolved, but is possible to recur in similar situations in the future. In any case, all relevant land in the HAMP PER is held in trust for The Hopi Tribe with the BIA as the trustee. Federal law does not require a Tribe to obtain its own consent for Tribal use of Tribal land. Therefore, the HAMP facilities will not require a Right of Way unless a third party is involved (e.g. electrical service, BIA, BIE, etc.) Similarly, there are and have been disputes with respect to Right of Way documentation of the BIA Keams Canyon facilities, which are also lands claimed by First Mesa Villages/Clans.

There has been little substantive action with respect to garnering the \$17.0M required to complete the project since 2014 other than a Tribal Contribution of \$0.2M under PH 15-E89. One of the largest obstacles to garnering funds is that The Hopi Tribe is out of compliance with the Single Audit Act as the FY2012 (i.e. most recent) audit was submitted to the Federal Audit Clearinghouse in February 2016 per the Hopi Tutuveni. As long as the Tribe is out of compliance with the Single Audit Act it is unlikely that they will be eligible for Federal funds in the required amount(s). Meanwhile, the Tribe has not yet submitted an application to USDA RD for review to ensure that the technical portion is sufficient per the USDA requirements. Similarly, the Tribe has not yet made a 25 percent funding obligation to the HAMP to match the likely USDA RD requirements. Due to water rights litigation throughout the course of the HAMP, the BOR has not yet been included in the HAMP per se. However, the Tribal study *Polacca Day School Well Assessment by the Bureau of Reclamation and The Hopi Tribe* was funded by the BOR to evaluate the Polacca Well #7 with respect to arsenic and determined the well to be more suitable for agriculture or construction than a potable source (Puhuyesva, 2012).

There has been a community development proposed adjacent to the Turquoise Trail wells (i.e. Tawa'ovi, formerly known as the Turquoise Community) for the past 30 years, but there has not been significant progress with respect to funding. IHS Project PH 93-370 was funded by the IHS in 1993 to develop water and sewer infrastructure for the Turquoise Community, but was cancelled due to lack of progress and funding of the homes. Since then, the IHS has been a participant in Tawa'ovi Community Development meetings in an effort to include the community in the HAMP should funding materialize. Tawa'ovi has been a subject of political debate that some have not considered mutually exclusive from the HAMP with respect to electrical negotiations and has escalated to significant tensions between certain individuals, Villages, Tribal entities, and Federal Agencies' funding abilities (e.g. exclusion of the community in planning efforts due to lack of a pro rata funding contribution). Similarly, the Tribe disapproved an awarded \$2.9M US Department of Transportation Transportation Investment Generating Economic Recovery (TIGER) grant due to political discourse involving Tawa'ovi, which may detrimentally affect future grant funding.

The most significant remaining issue other than funding is provision of power to the Turquoise Trail wells. While the wells can be operated on generators scoped to be provided for

emergency purposes, it is at prohibitively greater costs than grid power. Therefore, The Hopi Tribe has been in confidential electrical negotiations with Arizona Power Service (APS) and the NTUA for several years regarding the well sites. The most recent APS quote in February 2015 identified the cost to provide power to the wells (i.e. only the wells with no other demand included) at \$4.7M, which translates to an increase of \$2.9M to the estimate of \$1.8M identified in the HAMP PER. The cost increase is included in the IHS SDS entry "AZ09981-0601 - Hopi Arsenic Mitigation Project". The NTUA has not provided an estimate on the extension since the most recent request was made exclusively for the well sites (i.e. not including Tawa'ovi) in April 2016.

PROJECT COST SUMMARY

Planning and inspection efforts of PH 04-S63, PH 06-D33, PH 08-T38, and PH 10-E37 (i.e. the HAMP) were provided by the IHS under Direct Service and Government Procurement. Construction of Turquoise Trail Wells #2 and #4 was provided by The Hopi Tribe's Office of Financial Management under Tribal Procurement. Funding for PH 04-S63 and PH 08-T38 was provided by the IHS through "Regular" funds with funding for PH 06-D33 and PH 10-E37 provided by the EPA through SDWA Tribal Set-Aside funds. Additionally, the Tribe and EPA have funded subsequent ongoing projects that are considered wholly or partially components of the HAMP under PH 11-E55, PH 12-E73, PH 14-U62, PH 15-U76, and PH 15-E89.

The Tribe, IHS, and EPA have provided funding to-date with contributions of \$0.20M, \$1.15M, and \$5.33M, respectively. Approximately \$3.36M has been spent (i.e. more than the sum of the projects in this Final Report) on planning efforts including proving the quality and production of the Turquoise Trail Wells. There is currently \$3.09M cumulatively remaining in IHS Projects PH 12-E73, PH 14-U62, PH 15-U76, and PH 15-E89 that has been identified to construct scopes of the HAMP that have functional value if the HAMP does not proceed as scoped. The remainder of the HAMP is listed in the IHS SDS entry "AZ09981-0601 - Hopi Arsenic Mitigation Project" serving 1,281 homes at a total remaining cost of \$16,970,942.28 (i.e. total cost of \$23,501,800.28 included PER sunken costs, funds garnered to-date, and the additional power line extension cost).

Table 3 - Cost Summary

<u>Obligating Document</u>	<u>Description</u>	<u>Cost</u>
PH 04-S63	Risk Pool	\$ 16,650.00
	Credit card purchases	\$ 11,613.21
	Project Technical Support per PS	\$ 69,930.00
	Project Technical Support	\$ 7,390.49
EA 11-12	Turquoise Trail Wells 2&3	\$ 670,718.59
Kennedy/Jenks Consultants	Delivery Order	
	Strategic Plan	\$ 23,697.71
	Total	\$ 800,000.00
PH 06-D33	Credit card purchases	\$ 33,941.17
	Engineering Program Support	\$ 5,920.00
	Project Technical Support per PS	\$ 14,800.00
	Project Technical Support	\$ 972.94
EA 05-12	Cultural Resources Survey	\$ 26,230.56
Bohannon Huston Inc.	Delivery Orders	
	Environmental Assessment	\$ 21,967.53
	Well Drilling Inspection	\$ 76,167.80
	Total	\$ 180,000.00
PH 08-T38	Credit card purchases	\$ 1,000.00
	Project Technical Support	\$ 15,600.00
EA 11-12	Turquoise Trail Wells 2&3	\$ 133,400.00
	Total	\$ 150,000.00
PH 10-E37	Credit card purchases	\$ 180.83
	Engineering Program Support per PS	\$ 62,887.00
	Engineering Program Support	\$ 0.65
	Project Technical Support	\$ 188,660.00
EA 11-12	Turquoise Trail Wells 2&3	\$ 1,436,235.67
Kennedy/Jenks Consultants	Delivery Orders	
	Hydrogeological Study	\$ 86,877.00
	Strategic Plan	\$ 82,558.85
	Total	\$ 1,857,400.00

TOTAL	EA 05-12 Cultural Resources Survey	\$ 26,230.56
	EA 11-12 Turquoise Trail Wells 2&3	\$ 2,240,354.26
	Kennedy Jenks Consultants	
	Hydrogeologic Study	\$ 86,877.00
	Strategic Plan	\$ 106,256.56
	Bohannon Huston Inc.	
	Environmental Assessment	\$ 21,967.53
	Well Drilling Inspection	\$ 76,167.80
	Risk Pool	\$ 16,650.00
	Credit card purchases	\$ 46,735.21
	Engineering Program Support (EPS)	\$ 93,807.65
	Project Technical Support (PTS)	\$ 297,353.43
	Total	\$ 3,012,400.00

Funding Summary

EPA SDWA Tribal Set-Aside	\$ 2,062,400.00
IHS "Regular"	\$ 950,000.00
Total	\$ 3,012,400.00

OPERATION AND MAINTENANCE

All of the existing utilities scoped to be included in the HAMP PER agreed to Arsenic Compliance Plans with the EPA to provide water in compliance with MCLs by January 2015, of which no system has accomplished as of August 2016. Therefore, EPA enforcement action is pending against every utility involved. Similarly, the BIA Keams Canyon PWS was subject to a September 2013 EPA enforcement action for arsenic (and other violations) in the amount of \$136,000.

It is proposed that a utility organization called the Hopi Public Utility Authority (HPUA) subsidiary to and initially funded by The Hopi Tribe will be created to operate and maintain the majority of the HAMP facilities. The HPUA was established under the Hopi Public Utility Authority and Hopi Public Utility Commission Establishment Act, Ordinance No. 60 in May of 2013 by Hopi Tribal Council Resolution H-039-2013. While the HPUA exists only in writing at this time, the Director position was funded by the Tribe in the amount of \$250,000.00 in June 2016 and subsequently advertised. It is anticipated that the formation of the Hopi Public Utility Commission (HPUC) will occur following the hiring of a Director and oversee the HPUA. The HPUA is then anticipated to build the utility such that it will be capable of receiving HAMP facilities, scope remaining O&M line items per the PER and *Hopi Water System Strategic Plan An Element of the Hopi Arsenic Mitigation Project Final Report*, locate funding, and implement the HAMP.

The HAMP PER has identified \$355,000 in O&M materials and equipment to be requested as part of the HAMP capital cost. The structure and operation of the HPUA is more comprehensively outlined in the *Hopi Water System Strategic Plan An Element of the Hopi Arsenic Mitigation Project Final Report* with costs also delved into in the *Hopi Arsenic Mitigation Project Life Cycle Cost Analysis and Comparison of Arsenic Mitigation Alternatives: HAMP Groundwater System and Village Arsenic Treatment Systems Final Report*, and HAMP PER.

TRAINING

The *Hopi Water System Strategic Plan An Element of the Hopi Arsenic Mitigation Project Final Report* has outlined recommended training subjects per the following:

Operator Training

- Before startup
 - HAMP system overview and operating procedures
 - Equipment operation and maintenance
 - Regulatory requirements, sampling, and reporting
 - Recordkeeping
 - Safety
 - Emergency response procedures
- After startup and ongoing
 - Water system fundamentals (e.g. math, chemistry, hydraulics)
 - Laboratory and sampling procedures and operator testing
 - Asset management practices
 - Maintenance management
 - Certification exam preparation
 - Safety
 - Emergency response review and exercises
 - Computer and control systems

Management and Administrative Staff Training

- Before startup
 - System overview and service performance measures
 - Financial practices and accounting
 - Regulatory requirements
 - Emergency response
 - Computer systems
- After startup
 - Personnel management
 - Communication skills and procedures
 - Contract preparation and management
 - Project management

- HPUC Training
 - o System overview and service performance measures
 - o Policymaking and board roles and responsibilities
 - o Financial requirements and systems
 - o Regulatory requirements

The HAMP PER has identified \$12,000 in startup assistance and \$40,000 in O&M manual development to be requested as part of the HAMP capital cost.

TRANSFER OF FACILITIES

A letter of acknowledgement of completion of the projects was approved by the IHS Phoenix Area Director in _____. The letter also transferred all IHS vested interests in the sanitation facilities constructed under Projects PH 04-S63, PH 06-D33, PH 08-T38, and PH 10-E37 to the Tribe.